REMARKS

Upon entry of this Amendment, claims 1 to 12 and 14 to 19 will be pending, of which, claims 1 and 19 are independent. Claim 13 has been cancelled. Reconsideration and allowance of the present application based on the following remarks are respectfully requested.

The present application relates to "pin-fin" heat exchangers containing a stack of perforated metal plates. These plates contain column precursors joined together by ligaments which allow for fluid flow across the face of the plate. When these plates are stacked, the column precursors of one plate align with the coincident precursors of the plates above and below resulting in an array of individual columns perpendicular to the plane of the plates. In addition, the plates comprise loops that result in the formation of tanks at the sides upon stacking the plates.

Claims 4 to 18 stand objected to under 37 C.F.R. §1.75(c) as being improperly dependent. These claims have been amended to overcome the objection.

Claim 3 was rejected under 35 U.S.C. §112, second paragraph, as being indefinite. Claim 3 refers to unperforated plates (S) at the top and bottom of the stack. The Examiner contends that the unperforated plates (S) contain perforations (59). The Applicants respectfully disagree because 59 is not a perforation in the plate but rather an aperture at the corner of the plate. This aperture is formed from the metal loop 58. When the plates are stacked, the individual apertures on each plate form tanks through which inlets and outlets to and from the stack can be positioned. The aperture 59 on plate S (figure 13) is similar to aperture 13 as described for figure 1 on page 10, 5th paragraph in the specification as filed.

Claims 1 and 19 were rejected under 35 U.S.C. §102(b) as being anticipated by Schubart (U.S. Pat. No. 1,734,274). Claims 1, 3/1, and 19 were rejected under 35 U.S.C. §102(b) as being anticipated by McMahon *et al.* (U.S. Pat. No. 2,537,276). Claims 1 to 3 and 19 were rejected under 35 U.S.C. §102(b) as being anticipated by Nguyen (U.S. Pat. No. 5,016,707).

Claims 1 and 19 have been amended to incorporate the limitations of claim 13 (which has been cancelled) and to recite the ability of the plates for fluid flow across the plane of the plate. Support for these amendments can be found in the specification as filed. For example, fluid flow across the plane (or face) of the plate can be found on page 12, 2nd paragraph.

Similarly, the formation of tanks on the sides of the stack from the individual plate loops can be found on page 10, 5th paragraph. As amended, these claims are not taught by any of these references for at least the following reasons.

None of the references cited disclose the ability of fluid flow within the plane of the plate, much less the loops on the plate, which when stacked form tanks on the sides of the stack. Consequently, the present invention is not anticipated by any of the cited prior art.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached Appendix is captioned **"Version with markings to show changes made"**.

CONCLUSION

As all the objections and rejections noted in the Office Action have been addressed, Applicants request reconsideration of the present application and submit that this application is in condition for allowance. A timely Notice to that effect is respectfully requested. Should questions relating to patentability remain, the Examiner is invited to contact the undersigned to discuss the same.

Respectfully submitted,

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Enclosure: Appendix

APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

1. (Amended) A heat exchanger **[(50)]** comprising a stack of parallel **[perforated]** plates, wherein **[(10, 20, 30, 70, 80),]**

each plate **[(10, 20, 30, 70, 80)]** of the stack having perforations **[(15A), characterised in that the perforations (15A) define]** defining an array of spaced column precursors **[(16, 21, 31),]** of thickness equal to the plate thickness,

said **[the]** column precursors **[(16, 21, 31)]** being joined together by ligaments **[(17, 22A, 22B, 32, 33), each ligament extending between a pair of adjacent column precursors ,the ligaments (17, 22A, 22B, 32, 33)]** having a thickness less than the plate thickness,

each ligament extending between a pair of adjacent column precursors **[(16, 21, 31)]** such that the column precursors of any one plate being coincident in the stack with the column precursors **[(16, 21, 31)]** of any adjacent plate, whereby the stack is provided with an array of individual columns, each column extending perpendicularly to the plane of the plates **[(10, 20, 30, 70, 80)]**,

each plate is provided with extensions in the form of loops which stack together to provide one or more tanks at the sides of the stack, and

whereby fluid flowing through the stack is forced to follow a tortuous flow path **[to flow]** around the columns, and has the ability to flow parallel to the plane of each said plate.

2. (Amended) A heat exchanger according to claim 1, **[characterised in that]** wherein the ligaments **[(22A, 22B, 32, 33)]** of each plate **[(20, 30)]** of each pair of adjacent plates are displaced relative to those of the other plate of the pair.

3. (Amended) A heat exchanger according to claim 1 or 2, **[characterised in that]** wherein the top and bottom of the stack are closed by unperforated plates **[(S)]**.

4. (Amended) A heat exchanger according to claim 1 **[, 2 or 3]**, **[characterised in that]** wherein the stack has side plates which are formed by the stacking of unperforated border regions **[(11, 56, 71, 81, 91, 101)]** around the edges of individual plates of the stack, the unperforated border regions being integrally formed as part of the plate.

5. (Amended) A heat exchanger according to **[any preceding claim]** claim 1, **[characterised in that]** wherein the perforations **[(15A)]** in the plates and the reduced thickness of the ligaments **[(17A, 22A, 22B, 32, 33)]** are produced by photochemical etching or spark erosion.

6. (Amended) A heat exchanger according to **[any preceding claim]** claim 1, **[characterised in that]** wherein at least two differently perforated plates **[(20, 30)]** are used, the two plates having different ligament patterns.

7. (Amended) A heat exchanger according to **[any preceding claim]** claim 1, **[characterised in that]** wherein the column precursors **[(16, 21, 31)]** are of circular cross section.

8. (Amended) A heat exchanger according to **[any preceding claim]** claim 1, **[characterised in that it comprises]** wherein the heat exchanger further comprises a plurality of joined together stacks of the parallel perforated plates, each stack being separated from an adjacent stack by a solid unperforated plate **[(S)]** whereby two or more separate fluid stream passageways are provided.

9. (Amended) A heat exchanger according to **[any preceding claim]** claim 1, **[characterised in that]** wherein the perforated plates **[(10, 20, 30, 70, 80)]** are of metal of thickness 0.5 mm or less.

10. (Amended) A heat exchanger according to **[any preceding claim]** claim 1, **[characterised in that]** wherein the components of the stack are diffusion bonded together.

11. (Amended) A heat exchanger according to **[any preceding claim]** claim 1, **[characterised in that]** wherein the components of the stack are brazed together.

12. (Amended) A heat exchanger according to **[any preceding claim]** claim 1, **[characterised in that]** wherein the plates **[(10)]** of the stack are provided at their edges with extensions **[(14)]** to assist location of the plates in the stack.

14. (Amended) A heat exchanger according to claim 1 **[13]**, **[characterised in that]** wherein the loops **[(111, 121)]** are reinforced by cross-members **[(114, 124)]**.

15. (Amended) A heat exchanger according to **[any preceding claim]** claim 1, **[characterised in that it includes]** wherein the heat exchanger further comprises a plurality of stacks of plates and one pair of adjacent stacks are separated by a plate **[(I)]** having perforations **[(90)]** to allow controlled injection of fluid at higher pressure from one stack into fluid at lower pressure in an adjacent stack.

16 (Amended) A heat exchanger according to **[any preceding claim]** claim 1, **[characterised in that it additionally has]** wherein the heat exchanger further comprises a plurality of passageways **[(55, 104)]** to contain catalytic material, those passageways being separated by an intervening plate **[(S)]** from the stack of parallel perforated plates **[(10, 20, 30, 70, 80)]**.

17. (Amended) A heat exchanger according to claim 16, **[characterised in that]** wherein the passageways **[(104)]** to contain the catalytic material are defined between plates **[(100)]** having parallel ribs **[(103)]** running the length of the plates.

18. (Amended) A heat exchanger according to claim 16 or 17, **[characterised in that]** wherein the passageways **[(104)]** to contain the catalytic material closed at one or both of their ends by mesh material **[(55A)]**.

19. (Amended) A perforated plate, wherein the plate **[(10, 20, 30, 70, 80)]** has an array of spaced column precursors **[(16, 21, 31)]**, the column precursors being of thickness equal to the plate thickness and being joined together by ligaments **[(17, 22A, 22B, 32, 33)]**, each ligament extending between a pair of adjacent column precursors **[(16, 21, 31)]**, the ligaments having a thickness less than the plate thickness , wherein each plate is provided with extensions in the form of loops which stack together to provide one or more tanks at the sides of the stack, and whereby fluid has the ability to flow within the plane of said plate.

APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

1. (Amended) A heat exchanger **[(50)]** comprising a stack of parallel **[perforated]** plates, wherein **[(10, 20, 30, 70, 80),]**

each plate **[(10, 20, 30, 70, 80)]** of the stack having perforations **[(15A), characterised in that the perforations (15A) define]** defining an array of spaced column precursors **[(16, 21, 31),]** of thickness equal to the plate thickness,

said **[the]** column precursors **[(16, 21, 31)]** being joined together by ligaments **[(17, 22A, 22B, 32, 33), each ligament extending between a pair of adjacent column precursors ,the ligaments (17, 22A, 22B, 32, 33)]** having a thickness less than the plate thickness,

each ligament extending between a pair of adjacent **[the]** column precursors **[(16, 21, 31)]** such that the column precursors of any one plate being coincident in the stack with the column precursors **[(16, 21, 31)]** of any adjacent plate, whereby the stack is provided with an array of individual columns, each column extending perpendicularly to the plane of the plates **[(10, 20, 30, 70, 80)]**,

each plate is provided with extensions in the form of loops which stack together to provide one or more tanks at the sides of the stack, and

whereby fluid flowing through the stack is forced to follow a tortuous flow path **[to flow]** around the columns, and has the ability to flow parallel to the plane of each said plate.